Rastergraf

AgatePXC

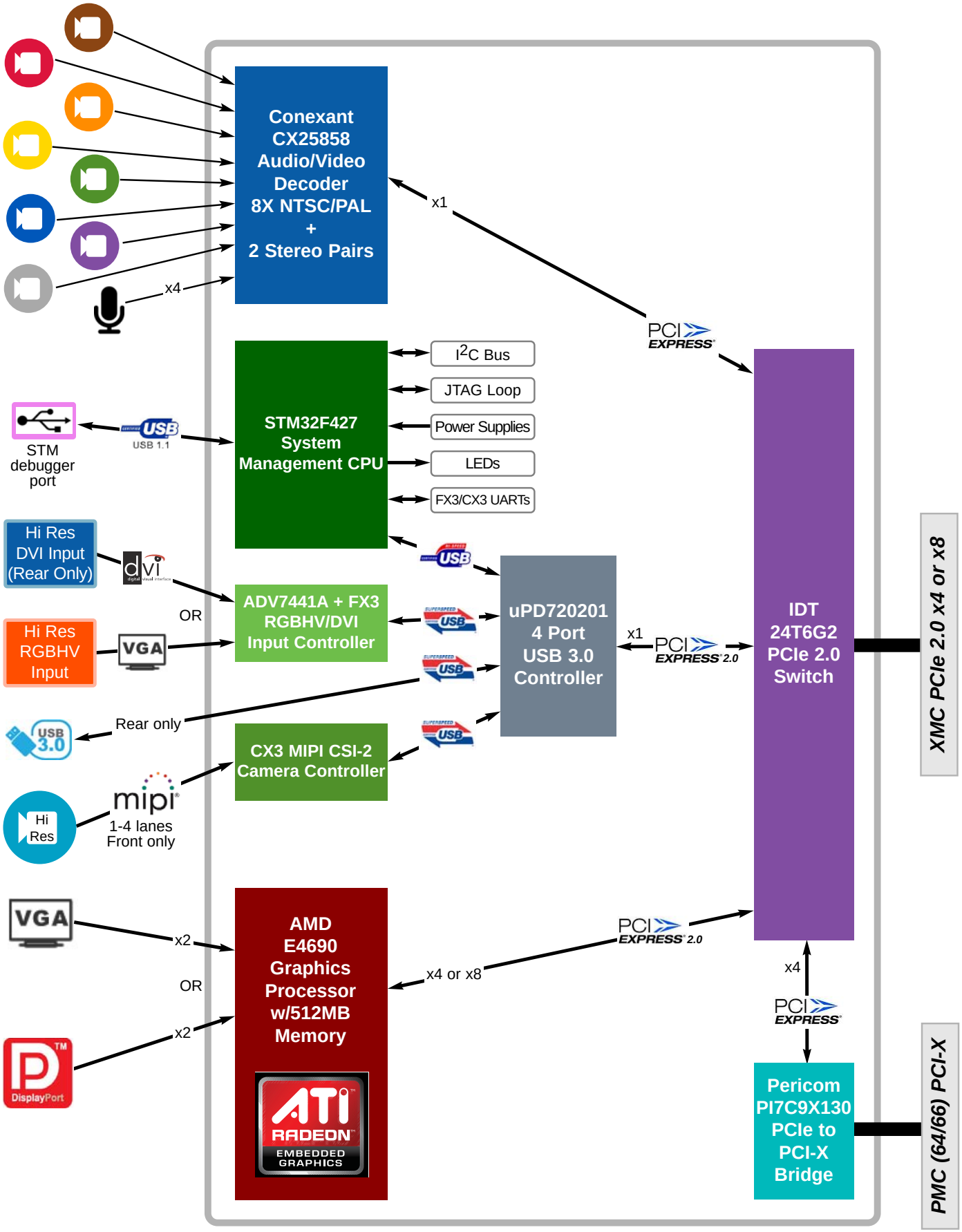
Dual Channel Graphics Controller for PMC and XMC with USB 3.0, Multichannel Video and Audio Digitizer, and Front and Rear I/O

Support for VxWorks ■ Linux ■ Windows

Features

- Dual channel AMD E4690 2D/3D graphics controller
- Dual host port interface: PMC (PCI-X) or XMC (x8 PCIe 2.0)
- Display resolution up to 2560x1600
- 512MB GDDR3 Graphics Memory On-chip
- x86 BIOS support
- Support for OpenGL 3.0 in Hardware
- Dual DisplayPorts on Mini DisplayPort (mDP) connectors
- Front panel display-only VGA, DisplayPort, or LVDS versions
- Rear (Pn4/Pn6) Connector Access including PIM support
- USB 2.0/3.0 (High & Super Speed) host controller
- Digitizes up to 8 each NTSC/PAL and audio simultaneously
- Single high-resolution RGBHV, DVI, or YUV input
- Single Multi-mode Analog Graphics output on I/O connector
- Front panel MIPI CSI-2 4-lane port
- On-board CPU provides comprehensive BIST support
- Extensive I^2C, ADC, and JTAG-based diagnostics
- Thermal sensors monitor E4690 and board temperatures
- VxWorks, Linux, and Windows XP/7/8

Figure 1: AgatePXC Block Diagram



AgatePXC Overview

The AgatePXC fulfills high performance requirements for a complete graphics and video acquisition solution found in VxWorks, Linux, and Windows embedded systems.

It can be used in an XMC, PMC, or XMC/PMC footprint and can operate in XMC locations with VPWR set to 5V or 12V. In a dual-bus footprint, it defaults to XMC.

The AgatePXC uses the AMD Radeon™ E4690 Embedded Graphics Processor, which includes 320 shader processors, a 128-bit memory interface, and 512MB of GDDR3 on-chip memory. The E4690 provides hardware support for OpenGL 3.0 and DirectX 10.1 as well as video codecs. Multiple HD video streams can be decoded at once.

The E4690 multi-mode analog graphics Ch 2 output supports NTSC or PAL (composite or Y/C component), RS-170, 1080p HD, VGA, RGB with or without Sync on Green, and STANAG 3350 Class A-C.

Screen resolutions of up to 2560x1600 are available with the AgatePXC/2 standard dual DisplayPort 1.1a outputs which use front panel Mini DisplayPort (mDP) connectors. External in-line “dongles” can transparently convert the mDP to DVI, VGA, NTSC/PAL, or a full-size DP connector.

Depopulated single purpose boards include VGA-only, DisplayPort-only, and LVDS-only models.

A front panel Honda SDR50 0.8mm connector provides the multi-mode graphics output, a MIPI CSI-2 port (4 lanes, 3.3V, I²C), 2 stereo audio inputs, 8 NTSC/PAL inputs, and a single RGBHV input.

Most I/O functions are also available on a combination of the XMC Pn6 and PMC Pn4 connectors. See Table 1 for a a summary of function availability.

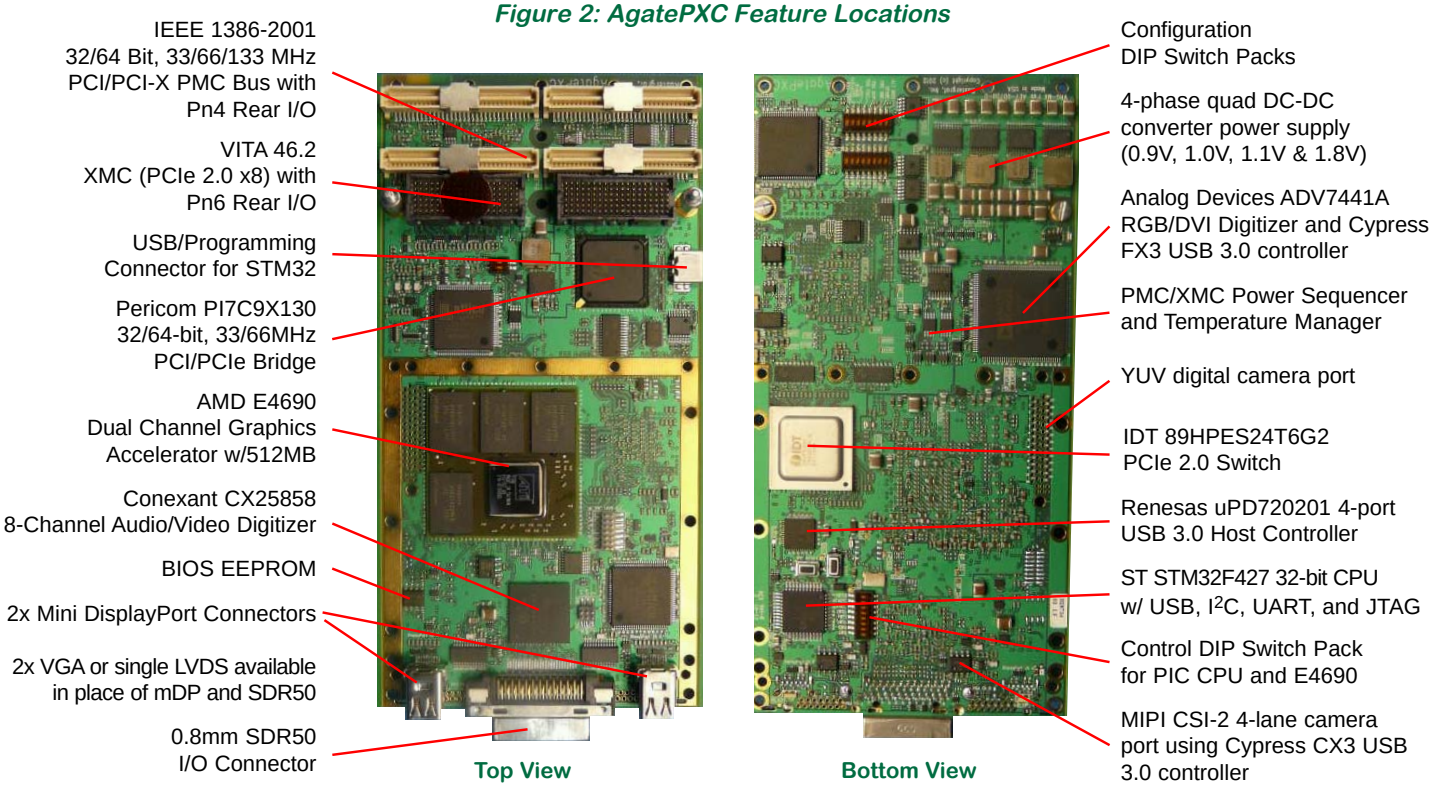
A “Personality Interface Module” (PIM) and a dual-purpose camera adapter boardlet are also available to ease connectivity to the Agate (see pages 8-9).

An ST Micro STM32F427 32-bit CPU provides Built-In Self Test (BIST) and monitoring of most AgatePXC functions using I²C, UART, JTAG, and on-chip A/D converters for voltage measurements. Reporting is done via LEDs and USB.

Embedded Life-Cycle Support

Rastergraf’s support philosophy recognizes the lead-in and life-cycle requirements expected by the embedded computing market. Please contact Rastergraf for more information or consult our web page at *www.rastergraf.com*.

Figure 2: AgatePXC Feature Locations

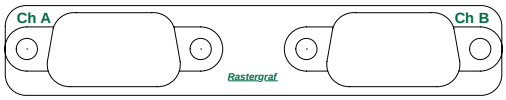

IEEE 1386-2001 32/64 Bit, 33/66/133 MHz PCI/PCI-X PMC Bus with Pn4 Rear I/O
VITA 46.2 XMC (PCIe 2.0 x8) with Pn6 Rear I/O
USB/Programming Connector for STM32
Pericom PI7C9X130 32/64-bit, 33/66MHz PCI/PCIe Bridge
AMD E4690 Dual Channel Graphics Accelerator w/512MB
Conexant CX25858 8-Channel Audio/Video Digitizer
BIOS EEPROM
2x Mini DisplayPort Connectors
2x VGA or single LVDS available in place of mDP and SDR50
0.8mm SDR50 I/O Connector
Top View
Bottom View
Configuration DIP Switch Packs
4-phase quad DC-DC converter power supply (0.9V, 1.0V, 1.1V & 1.8V)
Analog Devices ADV7441A RGB/DVI Digitizer and Cypress FX3 USB 3.0 controller
PMC/XMC Power Sequencer and Temperature Manager
YUV digital camera port
IDT 89HPES24T6G2 PCIe 2.0 Switch
Renesas uPD720201 4-port USB 3.0 Host Controller
ST STM32F427 32-bit CPU w/ USB, I²C, UART, and JTAG
Control DIP Switch Pack for PIC CPU and E4690
MIPI CSI-2 4-lane camera port using Cypress CX3 USB 3.0 controller

AgatePXC Versions

The AgatePXC/1x versions are display-only. The AgatePXC/2 includes the full feature set of the product line.The next page provides details about the display capabilities of each model.

AgatePXC/1V: Dual VGA Analog Outputs

The AgatePXC/1V provides two front panel VGA connectors. Each channel supports interlaced or non-interlaced RGBHV or RGB with composite or Sync-On-Green.



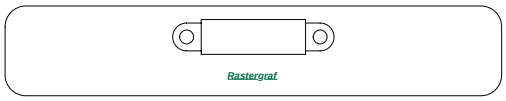
AgatePXC/1D: Dual DisplayPort Digital Outputs

The AgatePXC/1D provides two front panel 4-lane DisplayPort outputs using Mini DisplayPort (mDP) connectors.

AgatePXC/1L: Single LVDS Digital Output

The AgatePXC/1L provides a front panel LVDS connector using a Honda SDR26 connector with pinout that is Mini Camera Link compatible.

The output can be set up for graphics channel A or B, single or dual link, and 18 or 24 bpp pixel.



AgatePXC/1R: Single VGA Output

The AgatePXC/1R is a special purpose version that supplies a Rastergraf RG-101 compatible VGA output on the PMC Pn4 rear I/O connector.

AgatePXC/2: Analog and/or Digital Outputs plus I/O

The AgatePXC/2 front panel provides 2 Mini DisplayPort (mDP) connectors. It can also supply VGA Ch A and Ch B on the PMC Pn4 rear I/O connector.

It also has a front panel Honda SDR50 I/O connector that includes a multi-mode analog graphics output and a variety of audio and video inputs as described on page 6.

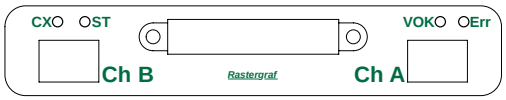


Table 1: Connectivity for the AgatePXC Models

Agate Version	XMC and/ or PMC	Cable(s) available from Rastergraf	Display Port Out Ch A/B	VGA Out Ch A	Multi-mode Analog Graphics Out (VGA Ch B)	8 Ch NTSC/PAL In	RGBHV In	DVI In	YUV In (no DVI or RGBHV In)	Audio In (stereo)	LVDS	MIPI CSI-2 Input	USB 2.0/3.0 host port
AgatePXC/1V	PMC*	no		VGA A	VGA B								
AgatePXC/1D	PMC*	no	mDP-A/B										
AgatePXC/1L	PMC*	no									SDR26		
AgatePXC/1R	PMC*	no		PMC Pn4 RG101									
AgatePXC/2	both	I/O Cable PIM Adapter	mDP-A/B XMC Pn6	PMC Pn4	SDR50 PMC Pn4	SDR50 PMC Pn4 XMC Pn6	SDR50 PMC Pn4 XMC Pn6	PMC Pn4 XMC Pn6	FPC	2 sets SDR50 1 set PMC Pn4 or XMC Pn6	n/a	SDR50	XMC Pn6

* XMC version available by special order

Graphics Display Capabilities

Table 2, below, provides the details about each possible graphics output from the E4690.

Note that regardless of the number of graphics connections on the front and/or rear panels, the E4690 itself allows ***only 2 channels to be active at one time.***

Optional external in-line dongles can convert the Mini DisplayPort output(s) to NTSC/PAL, DVI, VGA or LVDS. A passive cable can convert the Mini DisplayPort to the larger DisplayPort connector. Available cables and dongles are listed on page 15.

Power drawn on each DP or VGA port should not exceed 50mA (500mA peak). If more power is required, please use an external supply such as the Mouser 418-TR25D-01.

Figure 3: E4690 Graphics Output Section

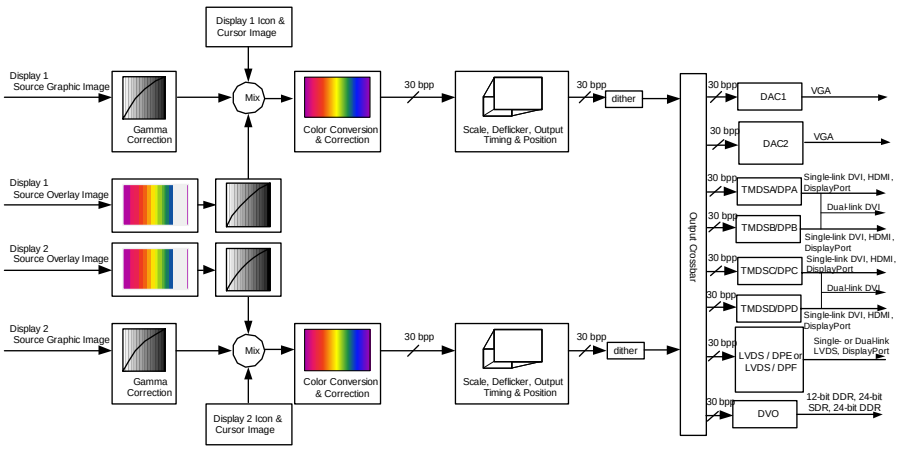


Table 2: AgatePXC Graphics Output Modes

Video Mode	Resolution	Colors	Channel	Availability	Comments
Digital DisplayPort	up to 2560x1600	up to 30 bpp	A, B	AgatePXC/2, /1D	up to 4 lanes, DP 1.1a
Analog Output interlaced or non-interlaced	up to 1920x1200	up to 24 bpp	A, B	AgatePXC/2, /1V	VGA, sync-on-green option
Analog Interlaced	RS-170 (640x480)	up to 24 bpp	B	AgatePXC/2, /1V	Composite
	PAL (768x575)	up to 24 bpp	B	AgatePXC/2, /1V	Composite or S-Video (Y/C)
	NTSC (640x480)	up to 24 bpp	B	AgatePXC/2, /1V	Composite or S-Video (Y/C)
Analog HD	up to 1080p	up to 24 bpp	A, B	AgatePXC/2, /1V	component YPbPr
Analog NonInterlaced	up to 1920x1200	up to 24 bpp	A	AgatePXC/1R	RG-101 compatible, one output
STANAG 3350 Class A-C	up to 875 lines	up to 24 bpp	B	AgatePXC/2	(contact Rastergraf for avail.)
Digital LVDS	up to 2048x1536	18 or 24 bpp	A, B	AgatePXC/1L	single or dual link

Audio and Video Input Capabilities

Hardware Notes

As shown in Table 3, below, the AgatePXC/2 provides six different input functions. Of those six, you can use only one out of DVI, RGBHV, or YUV at a given time because they share the same data path.

Since the CX25858, FX3, and CX3 can run simultaneously, you MUST have at least a 64/66 PCI/PMC or x4 PCIe host to attain optimal performance levels. The CX2585 won't even run on 32/33 PCI.

By default, 2 stereo pairs are provided on the SDR50 connector. By special order, an additional 2 pairs can be had in place of the multi-mode analog output.

Software Notes

Please see Software Support (page 11) for information about the FX3 and CX3 support.

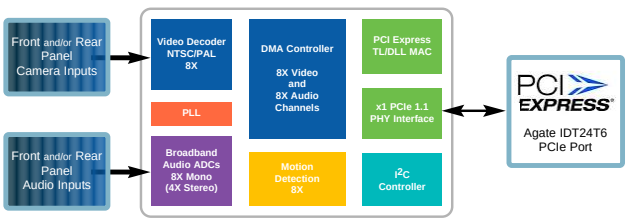
Table 3: AgatePXC Video Input Modes

Video Mode	Capture Controller	Example Camera	Typical Resolution	Capture Rate (typ)	Capture Mode	Front/Rear Accessibility	Notes
NTSC and/or PAL	CX25858		640x480 NTSC 768x576 PAL	30 NTSC 25 PAL	16-bit YUV	both	CX25858 can support a total of 8 NTSC and/or PAL cameras
RGBHV or DVI	7441A/FX3	PC	1600x1200 RGBHV 1920x1200 DVI	30	16-bit YUV	Both for RGBHV Rear for DVI	FX3 uses 7441A for RGBHV or DVI. YUV mode bypasses 7441A.
YUV Digital Input	FX3	OV5640Y	TBD	TBD	8-bit YUV	midboard edge	(see above)
MIPI CSI-2	CX3	OV5640M	2592x1944	15	16-bit YUV	front	

Multichannel Audio/Video Digitizer

The ***Conexant CX25858 8-input Audio/8-input Video Digitizer*** is PCIe-based and supports simultaneous digitizing of up to 8 each audio and NTSC/PAL video inputs. The CX25858 contains 8 high quality video decoders with 10-bit A/ADCs and 5-line comb filtering.

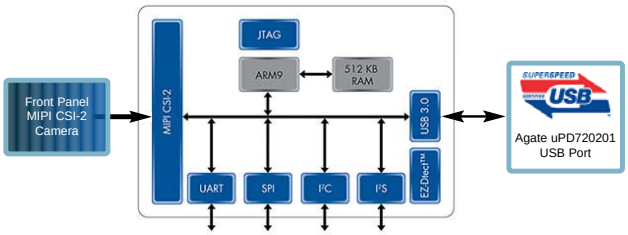
As normally configured on the AgatePXC/2, 2 stereo pairs and 8 video inputs are available on the front panel. Each video input can be independently scaled and includes per-channel programmable motion detection.


Front and/or Rear Panel Camera Inputs
Front and/or Rear Panel Audio Inputs
Video Decoder NTSC/PAL 8X
PLL
Broadband Audio ADCs 8X Mono (4X Stereo)
DMA Controller
8X Video and 8X Audio Channels
Motion Detection 8X
PCI Express TL/DLL MAC
x1 PCIe 1.1 PHY Interface
I²C Controller
PCI EXPRESS
Agate IDT24T6 PCIe Port

MIPI CSI-2 Input Port

A high performance USB 3.0-based ***Cypress CX3*** peripheral controller supports a MIPI CSI-2 camera port with up to 4 input lanes. Access is limited to the front panel.

An adapter boardlet (page 9) enables easy connection to an Avnet WandCam OV5640 high-resolution camera and the Agate 50-pin I/O breakout cable via a 33-pin 0.5mm FPC connector.

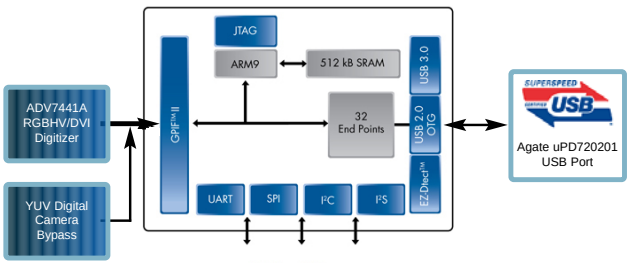


High Speed RGBHV or DVI Digitizer

An ***Analog Devices ADV7441A High Speed RGB/DVI Digitizer*** is linked to a ***Cypress FX3 Cypress FX3*** USB 3.0 peripheral controller.

The RGBHV can be accessed at both the front and rear panel. The DVI is only available at the rear panel.

The 8-bit portion of the FX3 YUV port can be accessed directly, bypassing the ADV7441A. This can be used to enable connection to an OV5640 high-resolution camera. An adapter boardlet (page 9) enables easy connection to the Agate via a 24-pin 0.5mm FPC connector.



USB 2.0/3.0 Host Controller

The AgatePXC/2 uses the quad-port ***Renesas uPD720201 USB Host Controller*** which is USB 3.0 (SuperSpeed), 2.0 (High Speed), and 1.1 (Full Speed) compatible.

USB 2.0 supports data rates up to 480 Mbit/s and USB 3.0 up to 5Gbit/s. USB 3.0 is especially suited for even the highest resolution video and data storage applications.

Please see Software Support (page 11) for information about the uPD720201, FX3 and CX3 software requirements.

Channel 1

USB channel 1 is connected to the STM32F427 BIST Subsystem CPU HS USB port. It is used by the BIST software to communicate with the XMC or PMC host CPU.

Channel 2

USB channel 2 is connected to the Cypress CX3 MIPI CSI-2 USB 3.0 peripheral controller. The MIPI connections are made on the SDR50 connector on the front panel.

Channel 3

USB channel 3 is available on the rear I/O (XMC Pn6) connector of the AgatePXC/2 as a standard USB 3.0 port. It supports both USB 2.0 and 3.0 modes. Note that USB Charger port operation is NOT supported.

Channel 4

Channel 4 is connected to the FX3 peripheral controller which is in turn linked to the ADV7441A RGB/DVI Graphics Digitizer.

Host Wiring

To help ensure that the USB 3.0 will work reliably over the host CPU or XMC carrier board, the Agate USB XMC wiring is length-matched and the pinouts follow differential data pair assignments as outlined in VITA 46.9 +X8d.

You will obtain best results if your host board complies with VITA 46.9 as well. If it doesn't, it is likely that the USB port will not be reliable at USB 3.0 speeds.

USB 3.0 Cables

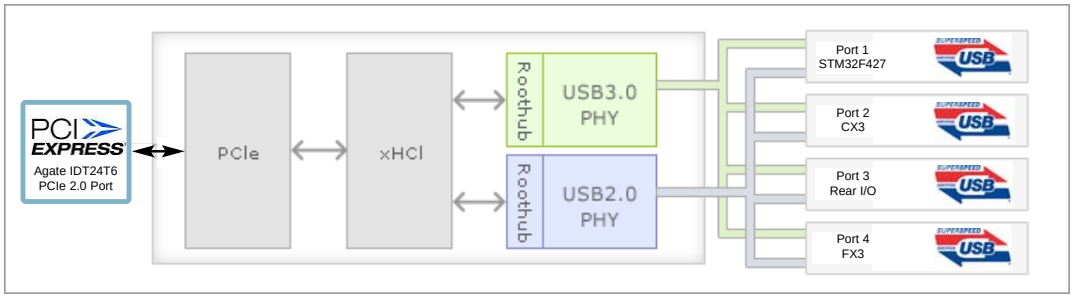
Note that unlike USB 2.0, it is pretty easy to build a USB 3.0 cable that ***doesn't*** work. Cabling requires very careful length matching shielded twisted pairs for the USB 3.0 Rx and Tx pairs. If at all possible, it would be best to use commercially built cables known to comply with the USB 3.0 SuperSpeed specifications.

Port Power

USB 3.0 specifies that 0.9A @5V be supplied. However, due to the overall power requirements of the board, the Agate is not able to deliver this much current.

The Agate uses a TPS2051B USB power controller, which has a design rating of 0.5A. As a practical matter, that can be exceeded, at least for a short time, depending on the operating temperature of the chip. But, if you know you are going to require on average more than 0.5A, please consider using an external supply such as the Mouser 418-TR25D-01.

Figure 4: uPD720201 Block Diagram



PIM Adapter

As of Agate Revision 2.0, a “Personality Interface Module” (PIM) is available that is VITA 36d0_1 compatible. It can be used with VME, cPCI, and OpenVPX PIM Carriers. It includes the XMC XIM enhancement suggested by Extreme Engineering which enables additional I/O to be supported.

When you use both the XMC Pn6 and PMC Pn4 connectors on the Agate PIM, all of the Agate rear I/O is accessible via a connectors mounted on both sides of the PIM, as shown in the diagrams below.

An alternate version includes a VME P2-style connector which allows the PIM to be used with Rastergraf and Technobox PMC and XMC carriers.

Camera Adapters

Part of the PIM is a snap-out mini-board, or boardlet, that can be used to ease the connection of cameras to the Agate. It is described in more detail on the following page. Most small cameras (see next page) connect to the controller with a 0.5mm FPC cable. There is not a lot of standardization so usually you have to make your own adapters.

The PIM camera adapter boardlet is double-sided:

a) Side 1 is for use with the Avnet WandCam MIPI CSI-2 camera.

b) Side 2 is for use with OmniVision OV5640Y YUV parallel data camera.

Figure 5: PIM Block Diagram

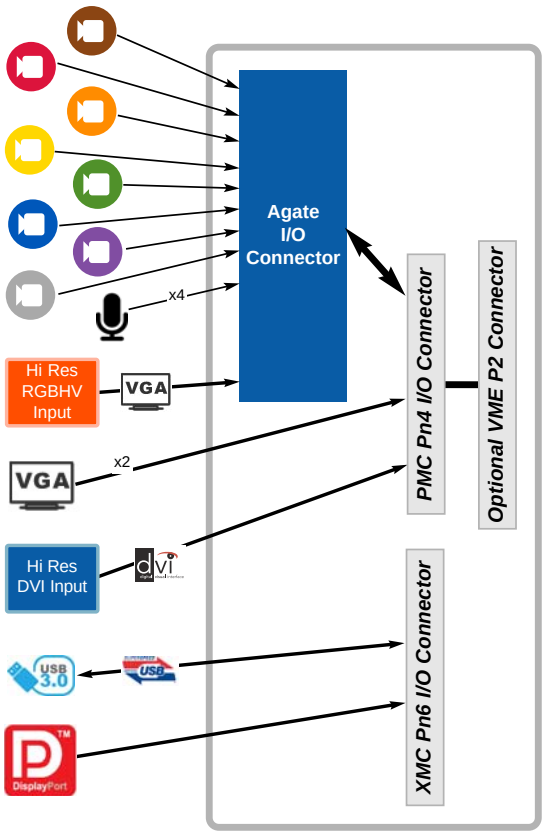
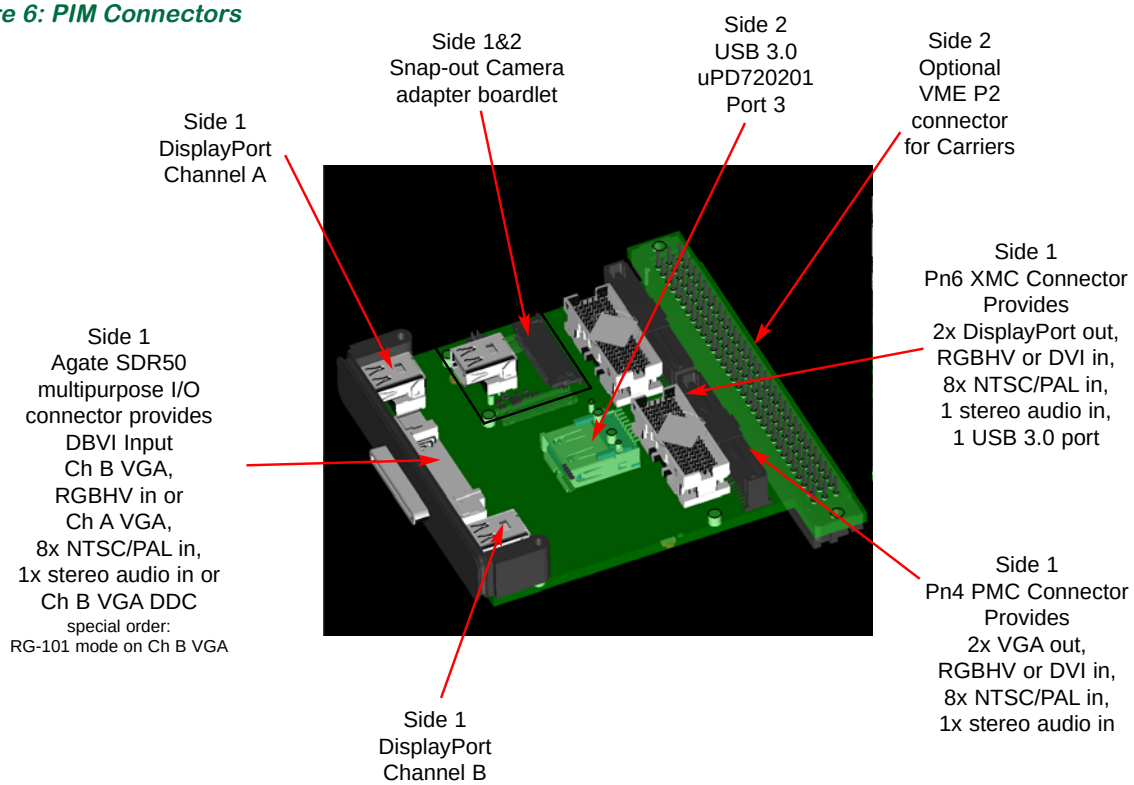


Figure 6: PIM Connectors



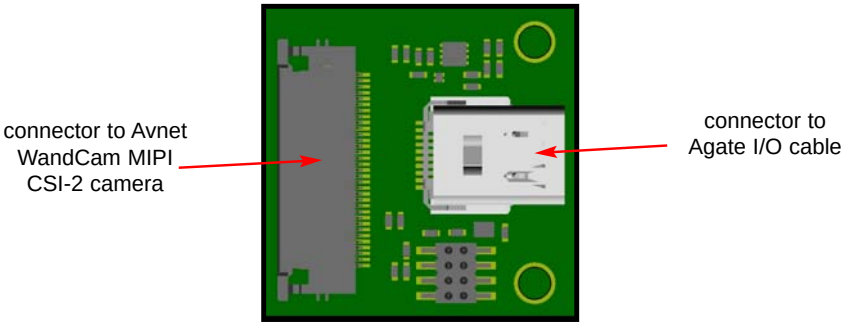
Adapter Boardlet Side 1: WandCam

Side 1 of the snap-out boardlet contains an adapter that supports the connection of an Avnet WandCam OV5640 MIPI CSI-2 camera to the Agate I/O Breakout Cable.

Any MIPI CSI-2 one to four lane camera that is compatible with the WandCam standard can be supported. Referring to the diagram below, the FPC (left hand) connector is linked to the WandCam via a short length of 0.5mm pitch FPC cable. The right hand connector links to the Agate cable. This is actually a Mini DisplayPort connector, which we use because it is a perfect signal match for MIPI CSI-2, for which there is no standard connector.

Figure 7: Avnet WandCam Front and Back Views

Figure 8: WandCam Adapter Boardlet



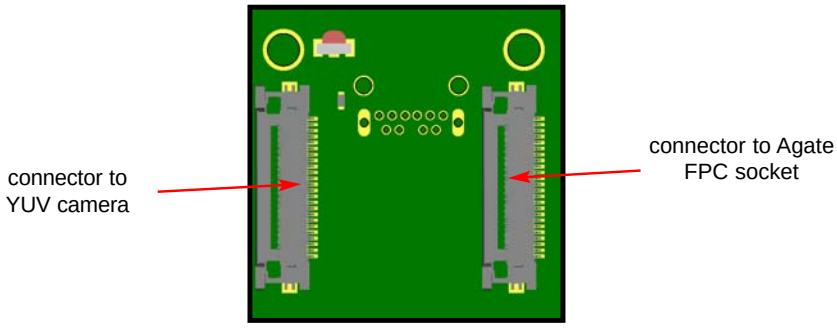
Adapter Boardlet Side 2: YUV Digital Camera

Side 2 of the snap-out boardlet contains an adapter that supports the connection of an 8-bit high resolution OV5640Y to an 24-pin FPC connector located mid-board on the Agate.

Referring to the diagram below, the FPC (left hand) connector is linked to the camera via a short length of 0.5mm pitch FPC cable. The right hand connector links to the Agate.

The Agate connector supplies 3.3V to the boardlet. Regulators on the boardlet derive 2.8 and 1.5V for the camera and apply them to the YUV camera connector

Figure 9: YUV Adapter Boardlet



Systems Management

There are a number of subsystems on the AgatePXC that are required to enable its correct and reliable operation. The startup of the power systems is set in motion by the leading edge of the system reset pulse. All host power must be stable at that time in order to ensure the proper operation of the board.

Power Supply Subsystem

By the very definition of a high-performance graphics board, the Agate is NOT a low-power design. For it to meet its full design specification, the calculated power requirements are:

Host Bus	Voltage Input	Idle	Full Operation
PMC/XMC	3.3V	0.9A	2A
PMC	5V	2.45A	6.85A
XMC	VPWR=5V	2.45A	6.85A
	VPWR=12V	1.1A	3A

At the leading edge of system reset, logic selects PMC or XMC as the power source (XMC is default). Because it can deliver the most power, 5V is the power rail for the 4-phase quad DC-DC converter supply. When XMC VPWR=12V, a local DC-DC converter is enabled to down-convert it to 5V. There is small efficiency cost to doing this but it simplifies the overall design. An OVP shuts down the entire power section if local 5V exceeds 5.6V.

Temperature Monitoring Subsystem

An LM63 thermal sensor tied to an E4690 substrate diode monitors the E4690 and the area around it. An LM75 sensor monitors the DC-DC converters area. If a thermal condition is detected, an LED is lit and, if required, the board is shut down. Recovery is done by cycling system power.

Cooling Systems

Copper floods enhance the heat-spreading within the PCB. The 24T6 and E4690 PCIe bus widths (set on-board to x4 or x8) and the E4690 clock and core voltage also affect power dissipation. The BIST subsystem can adjust the GPU parameters when temperatures rise too high. This may be a more effective way to manage heat than adding a heat sink that may congest the air flow through the cardcage. Tests will have to be run in the customer system to determine the impact.

Built-In Self-Test (BIST) Controller

An ST Micro STM32F427 CPU is used to provide Built-In Self-Test (BIST) and real-time monitoring of many AgatePXC functions using a combination of I^2C, JTAG, and A to D converters (ADC) for voltage measurements. The STM firmware includes support for boot-time register setup, device testing, and even CPLD reprogramming. The STM is connected to one of the uPD720201 USB ports so that it can be controlled by the host system.

Error Reporting

The simplest way that problems are reported is by LEDs:

On the front panel are:

- Red “Err” LED, which is turned on if a thermal sensor is tripped or some other problem is detected;
- Green “ST” LED driven by the STM, slowly cycles on and off.
- Green “VOK” LED, which is turned on when all on-board supplies are normal;
- Amber “CX” LED driven by the CX3, slowly cycles on and off.

On Side 2, along the board edge,

- Green, Amber, and Red LEDs driven by [STM OR 24T6 OR CPLD] control bits.
- Amber LED driven by the FX3, slowly cycles on and off.

In addition to the LEDs, the STM can communicate with the host system via an Agate USB port. No cabling to an CPU port is required.

System Management Connections

A Mini B USB connector located on the edge of the board enables access to the STM secondary USB port for use with USB peripheral devices.

A Micro AB USB connector is used as for debug but is NOT a USB port. It is used to support programming of the STM control store and to access the STM debug port.

Table 4: AgatePXC BIST Test Nodes

Access Method	Devices	Testing Method
I^2C	CY22393 Clk, 9DB403 Clk Bfr, ADV7441A Digitizer, 3x CPLD, LM75, LM63 24LC256 EEPROM, ADS1015 4x ADC, MIPI Port, CX25858 EEPROM, FX3 and CX3 Controllers, 9X130 PCI/PCIe Bridge, 24T6 PCIe Switch, E4690 Graphics	Verify and Initialize Control Registers
UART	Debug access to the FX3 and CX3 Controllers	Verify and Initialize Control Registers
JTAG	3x CPLD, 9X130 PCI/PCIe Bridge, 24T6 PCIe Switch, E4690 Graphics	ID and Boundary Test
HSYNC, VSYNC	ADV7441A Digitizer, E4690 Graphics	STM Counters
Voltage	Power Supply: VDD_CORE, VDD_10, VDD_11, VDD_18, ancillary supplies	STM A/D Inputs + ADS1015
Temperature	STM on-chip sensor, LM63 and LM75 Thermal Sensors, E4690 Substrate Diode	poll via I^2C registers

Software Support

Software support for the AgatePXC includes the SDL Subroutine Library, Windows XP/7/8 drivers, and an x.org accelerated X Server with OpenGL and Xv video input extensions

Table 5: Software Support Matrix (consult factory for current availability)

	SDL	X	DirectX10	Self Test using SDL	Multi-Head	OpenGL	x86 BIOS	USB
VxWorks x86/PowerPC	✓			✓	✓		✓	
Windows XP/7/8			✓		✓	✓	✓	✓
Linux x86/PowerPC	✓	✓		✓	✓	✓	✓	✓

SDL Graphics Library

SDL is a graphics library designed to be a device-independent programming interface and is supported by the GNU C compiler and linker. SDL is ideally suited to demanding board level and embedded systems applications. Drivers are available for selected host CPU boards and operating systems.

SDL is easy to use. It includes a graphics primitives that interface to the GPU accelerated functions. All primitives are drawn as single pixel lines. Rectangles, polygons, circles, ellipses, and chords can be filled with a solid color or stipple patterns.

Complete information about SDL is contained in the Standard Drawing Library C Reference Manual that is available for download from our web site at http://www.rastergraf.com.

SDL Feature Summary

- DisplayPort output up to 2560x1600
- Analog up to 1920x1200, interlaced or non-interlaced, optional Sync On Green or Composite Separate Sync
- NTSC, PAL, and STANAG 3350 Class A-C output
- HDTV output up to 1080p
- LVDS output up to 2048x1536
- Pixblits to/from the display and host memory
- Solid and dashed lines, polylines, and rectangles
- Polygons, ellipses, circles, sectors, chords
- Solid and Pattern Fills - Pixel Processing
- Proportional and Fixed Width Fonts
- Clipping Rectangle and Logical Origin
- 8/16/24 bpp
- Video Capture - NTSC/PAL, DVI, RGB

Built-In-Test

The Rastergraf SDL Subroutine Library includes a **BIT** module which tests the major devices and graphics memory, and a simple drawing engine test is also conducted.

uPD720201, FX3 and CX3 Support

The FX3 and CX use USB 3.0 links to connect to the host. On the Agate, this is done via the on-board Renesas uPD720201 USB 3.0 Host Controller. There are a few details that must be attended to ensure satisfactory results:

Your OS must include a UVC (USB Video Class) driver.

A Windows XP/7/8 driver for the uPD720201 can be downloaded from Rastergraf. Most Linux distributions appear to have the driver built in.

You can only use the USB-based FX3 and/or CX3 on VxWorks version 6.8 or later. Earlier versions such as 5.5 do not have adequate USB support.

To use the FX3 and/or CX3, you have to install the Cypress SDKs for XP/7/8 or Linux and the Java Runtime Environment from java.com. You can download the Agate-specific application images for the FX3 and CX3 from the Rastergraf web site.

Ruggedization

Rastergraf is not in the militarized business. The intent of the following table is to illustrate how the Rastergraf graphic boards fit into the standard ruggedized classes.

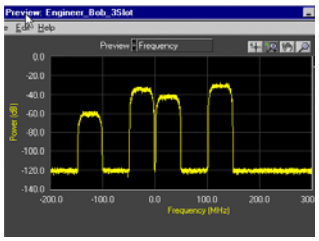
Rastergraf boards use standard distribution grade derated commercial temperature range or industrial temperature range components. No formal component tracking is maintained.

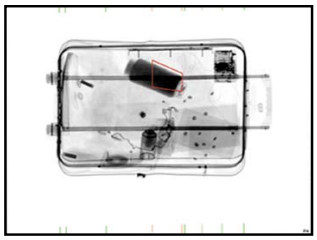
Table 6: Ruggedization Levels

Spec	Air-Cooled Level 0	Air-Cooled Level 50	Air-Cooled Level 100	Air-Cooled Level 200
Graphics Board(s)	Agate Topaz	Agate Topaz	Agate Topaz	Agate (TBD) Topaz
Operating Temperature (4, 6)	0°C to 50°C	-20°C to 65°C	-40°C to 71°C	-40°C to 85°C
Storage Temperature	-40°C to 85°C	-40°C to 85°C	-55°C to 125°C	-55°C to 125°C
Humidity Operating	0 to 95% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing
Humidity Storage	0 to 95% condensing	0 to 100% condensing	0 to 100% condensing	0 to 100% condensing
Vibration Sine (1)	2 g peak 15-2 kHz	2 g peak 15-2 kHz	10 g peak 15-2 kHz	10 g peak 15-2 kHz
Vibration Random (2)	0.01 g2/Hz 15-2 kHz	0.02 g2/Hz 15-2 kHz	0.04 g2/Hz 15-2 kHz	0.04 g2/Hz 15-2 kHz
Shock (3)	20 g peak	20 g peak	30 g peak	30 g peak
Conformal Coat (5)	optional	optional	optional	optional
Ordering Option (7)	/CA or /CS	/A5A or /A5S	/A1A or /A1S	/A2A or /A2S

Notes:

1. Sine vibration based on a sine sweep duration of 10 minutes per axis in each of three mutually perpendicular axes. May be displacement limited from 15 to 44 Hz, depending on specific test equipment. **Shock and Vibration values are by design and not tested in production.**
2. Random vibration 60 minutes per axis, in each of three mutually perpendicular axes.
3. Three hits in each axis, both directions, 1/2 sine and saw tooth. Total 36 hits.
4. Standard air-flow is 8 cfm at sea level. Some higher-powered products may require additional airflow. Consult the factory for details.
5. Conformal coating type to be specified by customer. Consult the factory for details..
6. Temperature is measured at the card interior (not at edge) using on-board LM75 temperature monitor.
7. Last letter in ordering option: A for Acrylic Conformal Coating, S for Silicone Conformal Coating





Specifications

Graphics Controller	**AMD Radeon E4690** (AKA M96 CSP or RV730, PCI Dev ID 9491)
Maximum Dot Clock	400 MHz
Horizontal Scan Rates	31.5 to 115 KHz
Display Memory	512 MB DDR3
Display Colors	16.7 Million @ 24-bits
Graphics Output	Standard output is 2x DisplayPort using Mini DisplayPort connectors. See note on Page 4 about power.
BIOS PROM	64Kb Serial EEPROM stores power-up configuration (BIOS). Optional secondary BIOS EEPROM.
PMC/PCI Bus Interface	**Pericom PI7C9X130** 32/64-bit, 33-133 MHz PCI/PCI-X to PCIe 1.1 x4 Bridge Supports Universal PCI Bus signaling (5V and 3.3V) on the PMC side.
XMC/PCIe Bus Interface	**IDT 89HPES24T6G2** 6 port PCIe 2.0 PCIe switch; each port is x4 PCIe lanes. Ports 0&1: connected to XMC, x4 or x8, PCIe 2.0; (power save option: x4 only) Ports 2&3: connected to E4690, x4 or x8, PCIe 2.0; (power save option: x4 only) Port 4: connected to uPD720201, x1, PCIe 2.0; Port 5: connected to CX25858, x1, PCIe 1.1
USB Host Controller	**Renesas uPD720201**, four port, USB 3.0/2.0 compliant, switched power control (see note on Page 4 about power). 64Kb Serial EEPROM stores power-up configuration. Port assignment allocates: Port 1 to STM32F427 BIST controller; Port 2 to Cypress CX3 USB 3.0-based MIPI CSI-2 camera controller; Port 3 to user XMC rear I/O; Port 4 to Cypress FX3 USB 3.0-based Peripheral Controller (interfaced to ADV7441A)
Video/Audio Digitizer	**Conexant CX25858**, 8 NTSC/PAL Composite Video In, 8 Audio In (standard Agate connects 4), all channels can be active at once. Video capture mode is 4:2:2 or 4:1:1, choice of NTSC or PAL affects all inputs; pairs of audio inputs can be configured for stereo. 2Kb Serial EEPROM stores power-up configuration.
RGBHV/DVI/YUV Digitizer	**Analog Devices ADV7441A** captures RGBHV (SOG or separate sync) or DVI (not simultaneously), 1600x1200x16bpp; interfaces to **Cypress FX3** USB 3.0 Peripheral Controller and uses modified Cypress video input application software. Front panel supports RGBHV in only. Rear I/O supports RGBHV or DVI. The ADV7441A output can be disabled and an 8-bit YUV camera can be connected via a mid-board connector to drive the FX3.
MIPI CSI-2 Digitizer	**Cypress CX3** USB 3.0 based controller for MIPI CSI-2 1-4 lanes captures high resolution camera input.
Power Requirements	AgatePXC can easily exceed the nominal power limits of PMC (7.5W). XMC really has no limits, being controlled by the amount of available cooling and host power supply capabilities. In order to achieve full operability, the AgatePXC/2 requires host power as follows:

Host Bus	Voltage Input	Idle	Full Operation
PMC/XMC	3.3V	0.5A	2A
PMC	5V	1.75A	6.85A
XMC	VPWR=5V	1.75A	6.85A
	VPWR=12V	1.1A	3A

Environment	
Temperature	0°C to +70°C, operating; -55°C to +85°C, storage
Humidity	5% - 95% non-condensing
PMC/XMC Mechanical	IEEE 1386-2001 [*except Side 2 max component height is approx. 3.1 mm instead of 2.1 mm. This is not a significant issue.*]
Dimensions	149 mm x 74 mm
Front Panel I/O Connectors	AgatePXC/1V: Dual VGA AgatePXC/1D: Dual Mini DisplayPort (mDP) AgatePXC/1L: Honda SDR26 AgatePXC/2: 2x mDP + Honda SDR50
Analog Monitor Support	Dual, VGA or RGB w/SOG, up to 1920x1200@24 bpp, interlaced/non-interlaced. Ch 2 also supports a variety of composite, HDTV, NTSC, and PAL formats.
Digital Monitor Support	Dual, DisplayPort 1.1a, up to 2560x1600
Maintenance Features	See Page 10

Non-standard Versions

If you have special configuration requirements that do not appear to be covered by the standard versions, please contact the sales department for assistance.

Ordering Information

Board Configurations

AgatePXC/2 **Rastergraf P/N AE7-00759-4000**

Runs in XMC, PMC, or XMC/PMC sites. AMD Radeon E4690 Graphics Accelerator, 512 MB GDDR3, dual front panel Mini DisplayPort (mDP) connectors. BIOS supports analog and digital displays for x86. 50-pin Front Panel connector provides access to MIPI CSI-2, multi-mode analog graphics out, RGBHV in, 8 channel NTSC/PAL video in, and 2 stereo pairs audio in. The rear access Pn4 (PMC) and Pn6 (XMC) connectors together generally duplicate the Front Panel features, omitting the MIPI camera input but adding a USB 2.0/3.0 port and a selectable DVI or RGBHV digitizer input.

AgatePXC/1V **Rastergraf P/N AE7-00759-0000**

PMC Only, AMD Radeon E4690 Graphics, 512 MB GDDR3, dual front panel VGA connectors.

AgatePXC/1D **Rastergraf P/N AE7-00759-1000**

PMC Only, AMD Radeon E4690 Graphics, 512 MB GDDR3, dual front panel Mini DisplayPort connectors.

AgatePXC/1L **Rastergraf P/N AE7-00759-2000**

PMC Only, AMD Radeon E4690 Graphics, 512 MB GDDR3, single SDR26 LVDS connector.

AgatePXC/1R **Rastergraf P/N AE7-00759-3000**

PMC Only, AMD Radeon E4690 Graphics, 512 MB GDDR3, single RG-101-compatible PMC Pn4 VGA output.

Notes: XMC version is available for /1V, /1D, /1L, or /1R by special order.
Silicone or acrylic Conformal Coating is available. Please contact factory for more information.
Extended Temperature Testing is available. Please contact factory for more information.

Software

Windows XP/7/8 Driver **Rastergraf P/N ASW-PMMS-0100**

OpenGL and DirectX accelerated display and video input drivers for Windows XP/7/8. USB and Audio are built into the OS.

Linux X Windows Driver **Rastergraf P/N ASW-PMLN-0300**

x.org-based X-Windows video input and graphics accelerated drivers for x86 or PowerPC Linux.

Rastergraf SDL **Rastergraf P/N ASW-PSDL-0400**

SDL Subroutine Library with video input and graphics drivers for x86/PPC Linux and x86/PPC VxWorks. API compatible with earlier SDL versions and Rastergraf/Peritek graphics boards.

Accessories (available from Rastergraf)

AgatePXC SDR50 Breakout Cable: **Rastergraf P/N A31-00759-5001**

1 x mDP (female)	Up to 4-lane MIPI CSI-2, 3.3V, I^2C
1 x VGA (female)	RGBHV In (1600x1200@16bpp)
1 x VGA (female)	Multi-mode Analog Graphics output
8 x BNC (female)	8 channel NTSC/PAL Video In
2 x 3.5mm stereo (female)	2 stereo channels Audio In

AgatePXC PIM Rear I/O Transition Adapter: **Rastergraf P/N A31-00759-6001**

AgatePXC Camera Adapter Boardlet: **Rastergraf P/N A31-00759-6002**

Double-sided board:
Side 1 enables connection to the Avnet OV5640 WandCam MIPI camera. It is used in conjunction with the Agate SDR50 Breakout Cable and uses a short Mini DisplayPort stub cable (mDP used for convenience only);
Side 2 is used with the YUV Digital Camera and plugs into the FPC connector mid-board on the Agate. It also provides regulated 2.8V and 1.5V for the camera using 3.3V provided by the Agate via the FPC.

(see next page for more Accessories)

Accessories (tested but not sold by Rastergraf)

Mini DisplayPort (mDP) to DisplayPort Cable:
1 x mDP plug to 1 x DP plug, 6 ft.: **StarTech MDP2DPMM6**

Mini DisplayPort (mDP) to VGA Active Adapter (Dongle):
1 x mDP plug to VGA output (receptacle), 1920 x 1200: **StarTech MDP2VGA**

Mini DisplayPort (mDP) to DVI Single Link Active Adapter (Dongle):
1 x mDP plug to DVI-D output (receptacle), 1920 x 1200: **Startech MDP2DVIS** or **HIS HMDPSDVIEYE**

Mini DisplayPort (mDP) to NTSC/PAL Active Adapter (Dongle):
1 ea mDP plug and USB (for power) to
1 ea RCA (composite) and DIN (S-Video)
1024x768 maximum display resolution output
Vktech/Lenkeng LKV386 or **ViewHD VHDMDP2AV (same)**

LVDS Adapter Cable (uses SDR26 Mini Camera Link pinout):
1 x SDR26 plug to MDR26 receptacle, 0.5m cable **Pureformance C20511A-0.5**

Avnet WandCam OV5640 MIPI CSI-2 Camera:
Requires Cypress CX3 SDK software for XP/7/8 (free from Cypress), Rastergraf MIPI boardlet, and Min DisplayPort Cable (mDP) is used for convenience). Cable should not be more than 1 meter. OV5640 camera supports up to 2592x1944@15fps. WandCam kit includes short FPC cable.

Go to http://www.em.avnet.com/en-us/design/drc/Pages/Wandcam.aspx **AES-WCAM-ADPT-G**

The Avnet picture shows both camera and controller but AES-WCAM-ADPT-G part number really includes just the camera and FPC cable.

8-Bit YUV OV5640Y Camera:
For use with Agate YUV FPC connector **OV5640 5PCS**.

Go to http://www.aliexpress.com/item/Sale-OV5640-camera-module-120-degree-wide-angle-5-million-pixels-5PCS/32215159543.html.

Note that this is for 5 cameras.

Contact Us

www.rastergraf.com

Rastergraf, Inc.
1810-J SE First Street
Redmond, Oregon 97756
tel: +1 (510) 849-4801
email: sales@rastergraf.com

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